

# **Severe Acute Respiratory Distress Syndrome (SARS)**

## **Summary**

### **Introduction**

Severe Acute Respiratory Distress Syndrome (SARS) is caused by a hitherto unknown and distinct variant of the coronavirus family, many members of which are responsible for the “common cold.” The SARS-associated coronavirus (SARS-CoV) is thought to have originated in the Guangdong Province of China, and been carried to other parts of the region by a local physician who had treated patients for “bird flu” and who subsequently traveled to Hong Kong in late February 2003. The initial reported cases of SARS included several international travelers staying at the same Hong Kong hotel as this physician.

In the weeks that followed, SARS spread rapidly to other countries in Asia, the Americas, and Europe, presumably by close contacts between air travelers, hospital workers, and relatives of infected individuals. Between November 2002 and July 2003, the WHO received reports of 8,098 cases of SARS, with 774 deaths. The majority of cases occurred in China and other parts of Southeast Asia. Only 8 laboratory-confirmed cases were identified in the United States. In April 2004, several new cases of SARS were identified in east-central China, prompting intense and ongoing surveillance by public health officials for further spread of this pathogen.<sup>1,2</sup>

The following is a summary of SARS, based upon the latest information from the Centers for Disease Control and Prevention (CDC) and the World Health Organization (WHO).

### **Clinical Features**

SARS is characterized by a flu-like illness, followed by severe lower respiratory involvement, including fulminant respiratory failure. SARS is clinically indistinct from other common causes of atypical pneumonia; however, most patients with SARS have clear epidemiologic links to other patient(s) with SARS or to settings where SARS-CoV transmission is occurring. Clinicians should consider the following epidemiologic indicators when evaluating the likelihood of SARS.

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<sup>1</sup> See <http://www.cdc.gov/od/oc/media/sars/cases.htm> for the latest United States SARS statistics.

<sup>2</sup> See <http://www.who.int/csr/sarscountry/en/> for SARS statistics compiled by WHO.

**Epidemiologic indicators:** CDC defines 2 levels of SARS activity: 1) no evidence of SARS transmission in the world, and 2) confirmed SARS cases somewhere in the world. In the absence of known human SARS cases in the world, SARS testing should be ordered only after consultation with Public Health authorities. This is because the likelihood of SARS is very low compared to other causes of atypical pneumonia and current diagnostic tests, while helpful, are not reliable indicators of infection in the early phase of the illness.

According to the current CDC algorithm for patient management, a patient must have atypical pneumonia on chest x-ray serious enough for hospitalization, plus have a history of travel to a former SARS-affected area, or a potential exposure in a health care setting, or exposure to another person with atypical pneumonia, AND have other possible causes ruled out by 72 hours of intensive diagnostic testing before a SARS test should be considered.

Once SARS activity is confirmed, the clinical management algorithm changes. Patients hospitalized with atypical pneumonia should be evaluated as above. In addition, all patients presenting with fever or symptoms of lower respiratory tract infection should be asked about any close contact with a suspected or confirmed case of SARS and about any recent travel, or contact with ill persons with a history of recent travel, to areas where confirmed or suspected SARS cases have occurred. If the patient's exposure history is positive, appropriate isolation precautions should be initiated immediately and an appropriate diagnostic work-up begun.

Clinicians should be aware that many cases of SARS have been associated with hospital-based transmission. At a time of no SARS activity in the world, clusters of pneumonia in healthcare workers are to be considered as one of the most likely sentinel events of re-emergence of the disease.

The CDC algorithms for the management of patients who are suspected of having been exposed to SARS are available at: <http://www.cdc.gov/ncidod/sars/clinicalguidance.htm>.

## **Diagnosis and Treatment**

**Incubation period:** 2-7 days, but may be as long as 10 (up to 14) days

## Presenting signs and symptoms:

- Early phase:
  - Fever ( $> 100.4^{\circ}\text{F}$  [ $38^{\circ}\text{C}$ ])
  - Chills and rigors
  - Headache
  - Malaise and myalgias
  - Occasional diarrhea (10-20% of cases)
  - **No associated rash**
  - **No neurologic symptoms**
- Lower respiratory phase:
  - Symptoms occur 2-7 days after the early phase
  - Dry, non-productive cough
  - Dyspnea
  - Hypoxemia
  - 10-20% of patients require ventilatory support
- Chest radiography:
  - Can be normal during early phase of illness
  - Most common presentation has been patchy, interstitial infiltrates
- Chest CT:
  - May show infiltrates earlier in the clinical course than chest radiography
- Laboratory findings:
  - Decreased absolute lymphocyte count
  - Leukopenia and thrombocytopenia have been seen in 50% of cases
  - Markedly elevated creatine phosphokinase (as high as 3000 IU/L) has been reported.
  - Elevation of hepatic transaminases has been seen in some patients.

## Diagnosis:

- Initial tests:
  - Chest x-ray
  - Complete blood count
  - Comprehensive chemistry panel (to include CPK)
  - Pulse oximetry or arterial blood gas
  - Sputum Gram stain and culture

- Blood cultures
- Specific pathologic tests currently recommended by CDC:
  - Enzyme immunoassay (EIA) to detect serum antibody to SARS-CoV
  - Reverse transcription polymerase chain reaction (RT-PCR) to detect SARS-CoV RNA
- Differential diagnosis:
 

Patients suspected of having SARS should also be tested for:

  - Serologies for respiratory syncytial virus
  - Serologies for influenza A and B
  - Urinary antigens for Legionella and S. pneumoniae (in adults with a positive CXR)

### **Case Definition:**

- According to the CDC, a confirmed case of SARS-CoV disease is a “person with clinically compatible illness and laboratory-confirmed infection<sup>3</sup>” (see below)
- Laboratory-confirmed SARS-CoV infection is defined as follows<sup>4</sup>:
  - Detection, with confirmation, of any of the following: a positive SARS-CoV serum antibody test on a single specimen, OR a documented four-fold or greater serum titer increase between acute and convalescent specimens, OR a documented seroconversion between acute and convalescent specimens. OR
  - Detection by RT-PCR, with confirmation, of SARS-CoV RNA from two clinical specimens, either from different sources OR from the same source on different days. OR
  - Positive viral culture, with confirmation.

At this time, except for persons with a known history of SARS infection, a positive antibody test is considered evidence of recent infection. It is important to note that serological testing, while helpful, is not a reliable indicator of infection in the early phase of the illness. The EIA for serum antibodies may not become positive until >28 days after illness onset. Only if the EIA remains negative more than 28 days after illness onset is SARS definitely excluded.

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<sup>3</sup> See <http://www.cdc.gov/ncidod/sars/guidance/f/pdf/app7.pdf> for information on interpreting SARS-CoV test results

<sup>4</sup> See above.

Similarly, a negative RT-PCR does not definitively exclude SARS as a potential diagnosis. While the test is highly sensitive and specific for a range of clinical specimens (e.g., serum, stool, respiratory secretions), the likelihood of detection is dependent on the viral concentration in the specimen being tested. Testing of multiple specimens, of different types and collected at different times, may therefore be necessary to detect SARS-CoV infection.

### Treatment

Intense supportive care.

No effective treatment for SARS has been found to date, and, although various antibiotics and antivirals as well as corticosteroids have been tried, no official evidence-based treatment recommendations have been published. Only vigorous supportive care, including management of the pneumonia as clinically indicated, and strict infection control precautions are recommended at present.

### **Isolation and Decontamination**

**Strict adherence to recommended infection control precautions, including hand hygiene, is of paramount importance when caring for a patient suspected of having SARS.**

Although the primary mode of transmission appears to be contact with infectious materials, including droplets, airborne transmission cannot be ruled out. **Airborne infection isolation** is therefore indicated for confirmed or suspected cases of SARS.

### Guidelines for *inpatient* care:

If a patient with suspected SARS is admitted to the hospital, **infection control personnel should be notified immediately.**

In addition, the following infection control measures should be taken:

- Standard precautions (e.g., hand hygiene). If hands are not visibly soiled, alcohol-based hand cleaning may be used as an alternative to hand washing with soap and water.

- Droplet precautions (i.e., *health care personnel should wear eye protection for all patient contact*)
- Contact precautions (i.e., use of gown and gloves for contact with the patient or their environment)
- Airborne infection isolation (i.e., an isolation room with negative pressure relative to the surrounding area and *use of an N-95 filtering disposable respirator for persons entering the room*)
- If patient care areas that support airborne precautions are not feasible or available, patients should be placed in a private room, and all persons entering the room should wear N-95 respirators.
- Regardless of the availability of facilities for full airborne precautions, *all other recommended precautions, including standard, contact, and droplet should be implemented for all suspected SARS patients.*
- Precautions should be continued until SARS has been ruled out or the patient is no longer considered infectious.

Guidelines for **outpatient** setting:

Patients who are determined to have possible SARS should be assessed in a separate patient care area to determine if they meet the case definition for suspected SARS.

- **Notify infection control personnel immediately.**
- If a patient requires isolation on arrival to the clinic or Emergency Department (ED), a mask (surgical or procedural) should be placed on the patient, and, if available, the patient should be placed in an airborne infection isolation room.
- All health care personnel should wear N-95 respirators while taking care of patients with suspected SARS.
- Strict hand hygiene and infection control measures as outlined above should also be employed.

For detailed information on infection control precautions, please visit the CDC website:

[http://www.cdc.gov/ncidod/sars/guidance/1/changes\\_v2.htm](http://www.cdc.gov/ncidod/sars/guidance/1/changes_v2.htm)

## **Travel**

During the first global outbreak of SARS, CDC issued a series of travel alerts and advisories for persons traveling to locations with confirmed SARS cases. Clinicians should be aware of the distinction between a travel alert and a travel advisory. An advisory recommends travelers defer all nonessential travel to an area because of a specific health problem, while an alert provides information about a health problem, specific precautions travelers should follow to reduce the risk of infection and procedures to follow if they become ill while traveling in an affected area. An alert does not include a recommendation to defer travel.

## **To Learn More**

Extensive information on SARS is available at the following CDC website: <http://www.cdc.gov/ncidod/sars/>

Thus summary was last updated on May 18, 2004.